RAVEN ROCK STATE PARK AQUATIC INVENTORY

by
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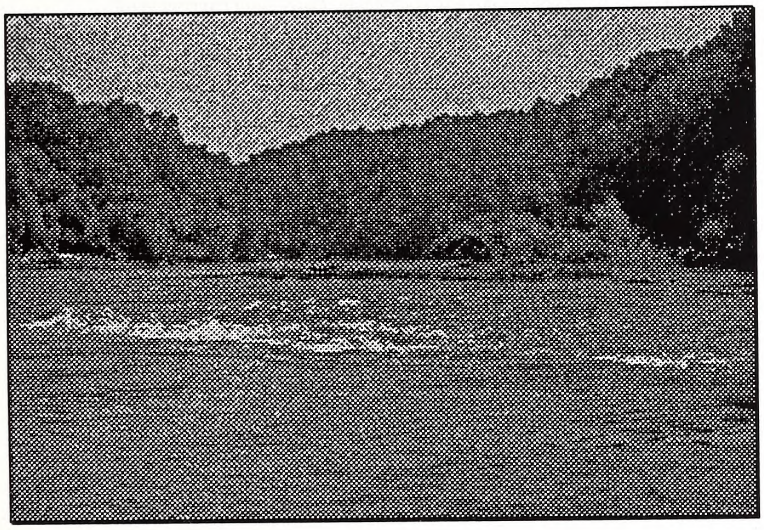
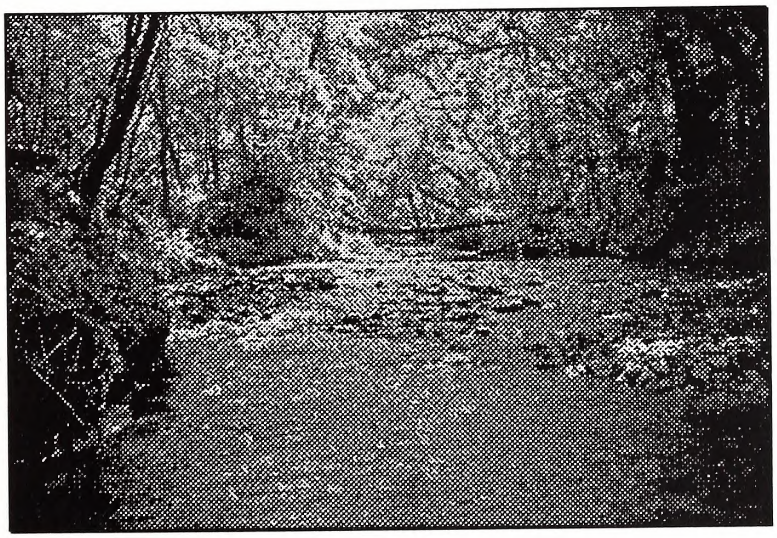
RAVEN ROCK STATE PARK
AQUATIC INVENTORY



Cape Fear River



Campbell Creek

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Raven Rock State Park Aquatic Inventory

Introduction

Raven Rock State Park is located in Harnett County and encompasses 2,847 acres. The main attraction of the park is Raven Rock. This is a crystalline structure that rises to 150 feet and stretches for over a mile along the Cape Fear River. Before this area became a state park, the lands were used for hunting, farming, and timber sales. Raven Rock was also a landmark for river pilots before the advent of the railroad. In 1965, local citizens rallied to have the area preserved as a state park. In 1969, the bill to have Raven Rock established as a state park passed the General Assembly. As the years passed, additional tracts of land were purchased.

The purpose of this project was to survey for aquatic species, including snails, mussels, sphaeriid clams, crayfish, and fish. Our inventory covered the Cape Fear River Basin tributaries flowing through Raven Rock State Park. These included: Avents Creek, Campbell Creek, Cedar Creek, Fish Creek, Hector Creek, Moccasin Branch, and the Cape Fear River. Figure 1 details the localities of all stations surveyed. The following sections provide information on the species in the above taxa documented at each site in the survey area.

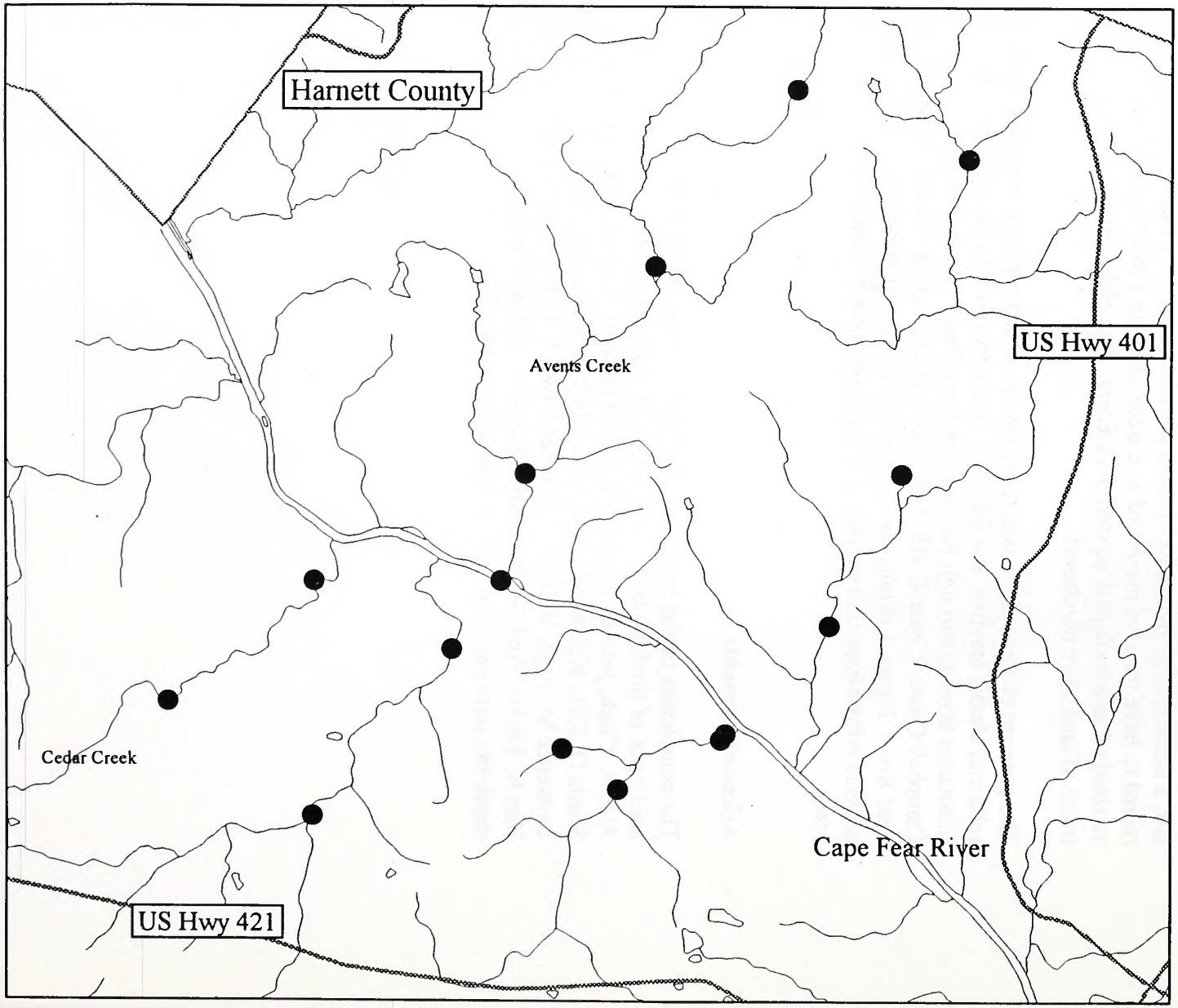
Acknowledgments

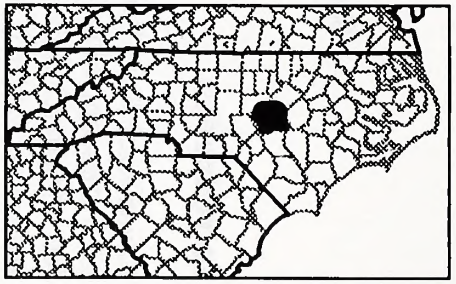
The completion of this project would not have been possible without the invaluable assistance of the following people: John M. Alderman, Alvin Braswell, Mike B. Carraway, Alan R. Clark, John E. Cooper, Mark A. Hartman, Tom Henson, Judith A. Johnson, Sheila D. Kirk, Ken Knight, Gerald L. Mackie, Andrew H. McDaniel, Jr., Chris McGrath, Lawrence M. Page, William M. Palmer, Louis P. Polletta, Danny Smith, Wayne Starnes, Ken R. Taylor, Fred G. Thompson, Randall C. Wilson, and Melissa R. Wood. We also thank the state park staff and the landowners who allowed us to work on their properties.

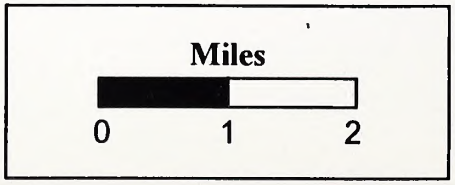
Gabriela B. Mottesi

RAVEN ROCK STATE PARK
STATIONS INVENTORIED

Figure 1.







Aquatic Snails

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NC Wildlife Resources Commission

Introduction

There are approximately 500 species of aquatic snails currently recognized in North America. These 500 species are divided into 78 genera and 15 families (Burch 1989). In North Carolina, there are approximately 52 species representing 8 families (Adams 1990).

Snails are grouped into one of two subclasses. Prosobranch snails are gill-breathing and have an operculum, which is a calcareous plate that closes the aperture when the snail withdraws into its shell. Pulmonate snails are lung-breathing and do not have an operculum to seal their aperture (Burch 1989).

These animals graze on algae and other microscopic organisms using radular teeth to grind food to an appropriate size for consumption. Snails are an essential part of aquatic ecosystems, as well as indicators of water quality. However, they are typically overlooked. The lack of information and knowledge of snails can be attributed, in part, to their minute size, perceived lack of activity, cryptic habits, and difficulty in identification.

Methods

Snails were surveyed in the Cape Fear River Basin tributaries flowing through Raven Rock State Park. These included: Avents Creek, Campbell Creek, Cedar Creek, Fish Creek, Hector Creek, Moccasin Branch, and the Cape Fear River (Fig. 1, Introduction Section). Most habitats can be described as riffle/run with medium to fast flow. Pools of different sizes with slow flow were also present. Substrate included combinations of silt, sand, gravel, cobble, boulder, and bedrock. Some aquatic vegetation and organic debris were also present.

Specimens were collected using visual and tactile searches. Due to the cryptic habits of some snail species, it was necessary to sift and dredge the substrate. All available habitats were sampled. Snails were preserved and stored in 70% ethanol.

Snails and limpet snails were identified using Burch (1989) and Basch (1963). Expected distributions and the following characteristics were used to identify the specimens: presence/absence of an operculum, direction of coiling, shell size, shape, color and thickness, texture of the shell, placement of apex, shape and number of the whorls, and the shape of the apertural lip. With the acquisition of additional information, identifications may be subject to change.

Results and Discussion

Snails were located at eight of the sites surveyed (Fig. 1). At least six species representing four families and both subclasses were found within the waterways associated with Raven Rock State Park (Table 1).

Campeloma decisum (Say, 1816), *Physella* sp., and *Helisoma anceps* (Menke, 1830) were collected in the backwater areas with slow flow in the mud/silt substrate. *Helisoma anceps* was also found in the aquatic vegetation. *Campeloma decisum* is considered a species complex (Adams, pers. comm. 1995). Therefore, when more information is acquired, this species complex may be separated into a few recognizable species.

Menetus dilatatus (Gould, 1841), *Ferrissia fragilis* (Tryon, 1863), and *Laevapex fuscus* (C.B. Adams, 1841) were found on the underside of rocks and on woody debris.

The following species were found in a survey of the Cape Fear River near the vicinity of Fayetteville: *Campeloma* sp., *Psedosuccinea columella*, *Ferrissia mcneilli*, *Physa* sp., and *Menetus dilatatus* (Aca. Nat. Sci. 1971). Although this survey is not representative of the survey which we conducted, it is good to note that some of the same species were found during our inventory.

The waterways associated with Raven Rock State Park support a fair diversity and abundance of aquatic snails. As is shown in Table 2, these species were found in relatively good numbers at each of the stations inventoried.

Resources

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Adams, W. F. (ed). 1990. A Report on the Conservation Status of North Carolina's Freshwater and Terrestrial Molluscan Fauna. The Scientific Council on Freshwater and Terrestrial Mollusks. 246 pp.

Basch, P. F. 1963. A Review of the Recent Freshwater Limpet Snails of North America (Mollusca: Pulmonata). Bulletin: Museum of Comparative Zoology, Harvard University. 129(8): 399-461.

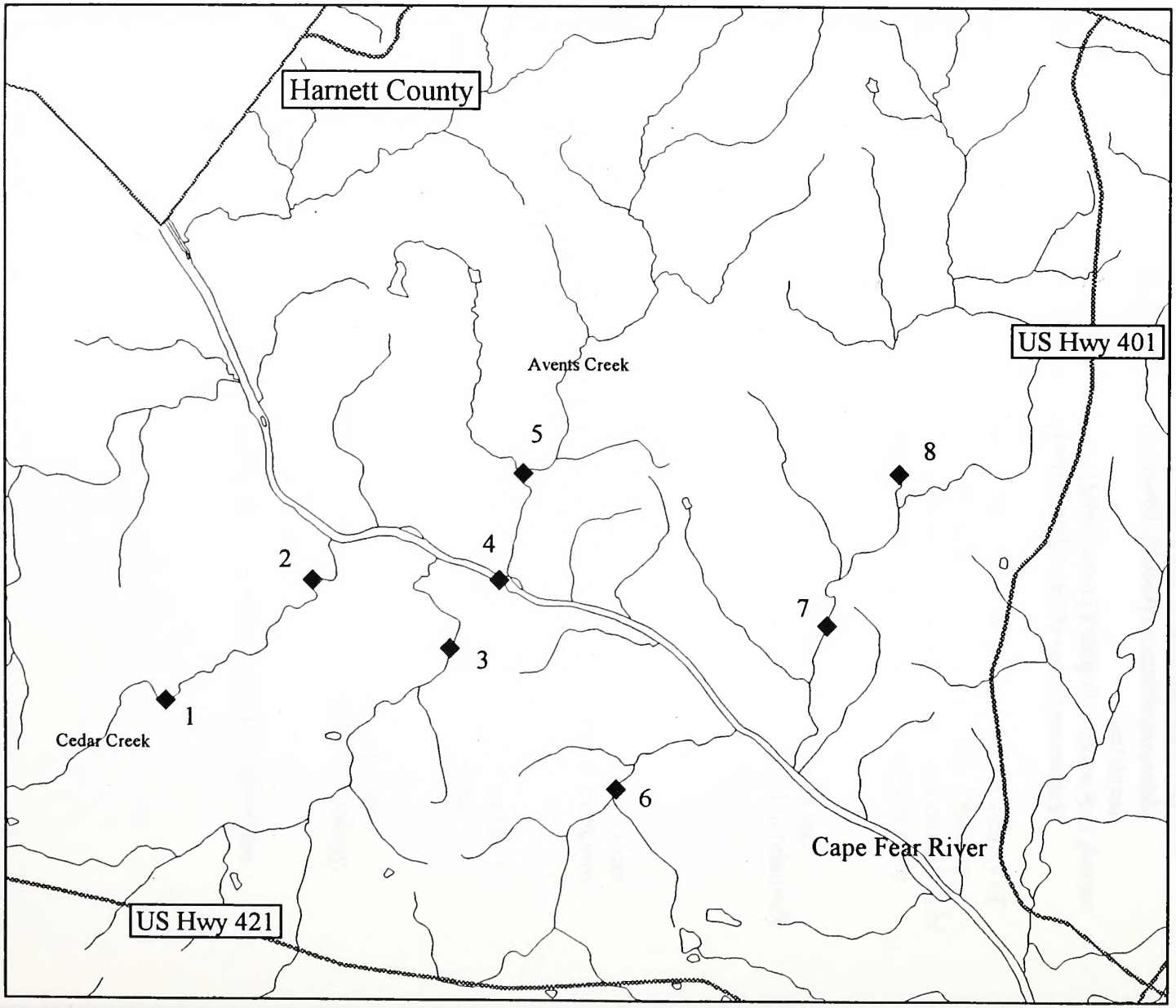
Burch, J. B. 1989. *North American Freshwater Snails*. Malacological Publications. Hamburg, MI. 365 pp.

Table 1. Snails found in the waterways of Raven Rock State Park

Prosobranchia	
Viviparidae	
Campeloma decisum (Say, 1816)	Pointed campeloma
Pulmonata	
Physidae	
Physella sp.	
Planorbidae	
Helisoma anceps (Menke, 1830)	Two-ridge rams-horn
Menetus dilatatus (Gould, 1841)	Bugle sprite
Ancylidae	
Ferrissia fragilis (Tryon, 1863)	Fragile ancylid
Laevapex fuscus (C.B. Adams, 1841)	Dusky ancylid

RAVEN ROCK STATE PARK
AQUATIC SNAIL SPECIES INVENTORY

Figure 1.



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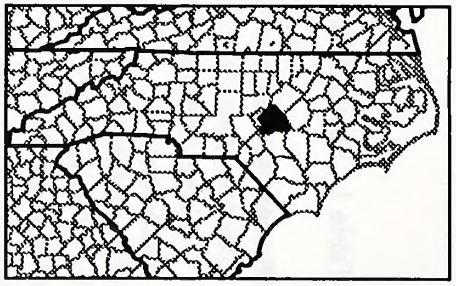

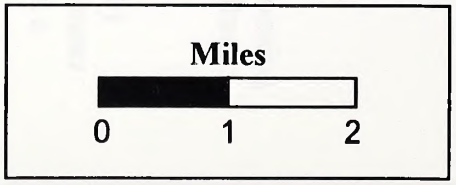

Table 2. Snails found in Raven Rock State Park and associated waterways

Station No.	Scientific Name	Waterway	Common Locality	County	Date	Number	Identified By
960418.1	*Campeloma decisum*	Avents Creek	SR 1418	Harnett Co., NC	18 April 1996	4	G.B. Mottesi
960701.1	*Laevapex fuscus*	Cedar Creek	SR 1265	Harnett Co., NC	1 July 1996	2	G.B. Mottesi
960708.1	*Physella sp.*	Fish Creek	SR 1257	Harnett Co., NC	8 July 1996	7	G.B. Mottesi
960708.1	*Ferrissia fragilis*	Fish Creek	SR 1257	Harnett Co., NC	8 July 1996	11	G.B. Mottesi
960708.1	*Menetus dilatatus*	Fish Creek	SR 1257	Harnett Co., NC	8 July 1996	2	G.B. Mottesi
960710.1	*Ferrissia fragilis*	Cedar Creek	Upstr. from confl. with Cape Fear	Harnett Co., NC	10 July 1996	12	G.B. Mottesi
960710.1	*Physella sp.*	Cedar Creek	Upstr. from confl. with Cape Fear	Harnett Co., NC	10 July 1996	11	G.B. Mottesi
960710.1	*Helisoma anceps*	Cedar Creek	Upstr. from confl. with Cape Fear	Harnett Co., NC	10 July 1996	12	G.B. Mottesi
960710.2	*Laevapex fuscus*	Cape Fear River	"Fish Traps", RRSP	Harnett Co., NC	10 July 1996	2	G.B. Mottesi
960710.2	*Physella sp.*	Cape Fear River	"Fish Traps", RRSP	Harnett Co., NC	10 July 1996	12	G.B. Mottesi
960710.2	*Helisoma anceps*	Cape Fear River	"Fish Traps", RRSP	Harnett Co., NC	10 July 1996	1	G.B. Mottesi
960805.1	*Menetus dilatatus*	Campbell Creek	Campbell Creek Trail	Harnett Co., NC	5 August 1996	1	G.B. Mottesi
960805.1	*Physella sp.*	Campbell Creek	Campbell Creek Trail	Harnett Co., NC	5 August 1996	10	G.B. Mottesi
960805.1	*Ferrissia fragilis*	Campbell Creek	Campbell Creek Trail	Harnett Co., NC	5 August 1996	3	G.B. Mottesi
960805.2	*Ferrissia fragilis*	Hector Creek	SR 1412	Harnett Co., NC	5 August 1996	4	G.B. Mottesi
960805.2	*Physella sp.*	Hector Creek	SR 1412	Harnett Co., NC	5 August 1996	1	G.B. Mottesi
960805.3	*Ferrissia fragilis*	Hector Creek	SR 1403	Harnett Co., NC	5 August 1996	5	G.B. Mottesi

Freshwater Mussels and Sphaeriid Clams

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NC Wildlife Resources Commission

Introduction

Freshwater mussels are in the Class Bivalvia. As the name implies, the mussel is separated into right and left shell-secreting centers. The shell itself is a single entity which is divided into right and left portions. Mussels are characterized by having greatly enlarged gills with ciliated filaments for filter feeding. Freshwater mussels are integral parts of many aquatic ecosystems. They provide nutrients for insects and other invertebrates and are a food source for other organisms. Because they are filter feeders, they are excellent indicators of water quality.

There are approximately 300 species and subspecies of freshwater mussels in the United States. The greatest diversity of these mussels occurs in the Southeast. Roughly 70 species can be found in North Carolina. Unfortunately, approximately half are state listed as Endangered, Threatened, or species of Special Concern (Adams 1990). It appears that the mussel fauna of the United States is in danger of extinction (reference Williams, et al. here). Therefore, it is necessary that we determine the status and distribution of these organisms so that proper management techniques can be applied.

Sphaeriid clams, like freshwater mussels, are in the Class Bivalvia and are filter feeders. The members of this family are considered the pea, pill, nut, or fingernail clams. Because of their well-developed mechanism of passive dispersal and adaptability, sphaeriid clams can be found in almost any body of freshwater. Therefore, their distributions are considered truly cosmopolitan (Branson 1988). In spite of their cosmopolitan distribution, not much is known about sphaeriid clams. They are represented in North America by 38 species of the family Sphaeriidae. In North Carolina, there are approximately 13 species of sphaeriid clams (Adams 1990).

One exotic species, the Asian clam (*Corbicula fluminea* (Müller 1774)), of the family Corbiculidae (Burch 1975) was introduced into this country in 1937 and was found throughout the entire area surveyed.

Methods

Freshwater mussels and sphaeriid clams were surveyed in the Cape Fear River Basin tributaries flowing through Raven Rock State Park. These included: Avents Creek, Campbell Creek, Cedar Creek, Fish Creek, Hector Creek, Moccasin Branch, and the Cape Fear River (Fig. 1, Introduction Section). Most habitats can be described as riffle/run with medium to fast flow. Pools of different sizes with slow flow were also present. Substrate

included combinations of silt, sand, gravel, cobble, boulder, and bedrock. Some aquatic vegetation and organic debris were also present.

Various techniques were used including snorkeling, sifting of the substrate, visual and tactile searches, and visual searches of the shores for shells. Live mussels were identified, measured, and returned unharmed to the appropriate habitat. Fresh shells were identified, measured, and kept for curation. With the acquisition of additional information, identifications may be subject to change.

Results and Discussion

Figure 1 details the localities of the five stations where freshwater mussels were found. At least seven species of mussels, all in the family Unionidae, were found in the waterways associated with Raven Rock State Park (Table 1).

Sphaeriid clams were not detected in any of the waterways associated with Raven Rock State Park.

The specimens falling into either the *Elliptio complanata* or *Elliptio icterina* complexes were listed under the *Elliptio* spp. category. Therefore, these complexes possibly contain several species. The ecophenotypes of these *Elliptio* complexes are found at numerous sites throughout eastern North Carolina (Alderman, pers. comm., 1997). Additional genetic information is necessary to determine the number of species within these complexes.

Fair diversity and a good abundance of mussels occur within the waterways associated with Raven Rock State Park (Table 2).

Resources

Adams, W. F. (ed). 1990. A Report on the Conservation Status of North Carolina's Freshwater and Terrestrial Molluscan Fauna. The Scientific Council on Freshwater and Terrestrial Mollusks. 246 pp.

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Johnson, R. I. 1970. *The Systematics and Zoogeography of the Unionidae (Mollusca: Bivalvia) of the Southern Atlantic Slope Region.* Harvard University. Cambridge, MS. 140(6): 263-450.

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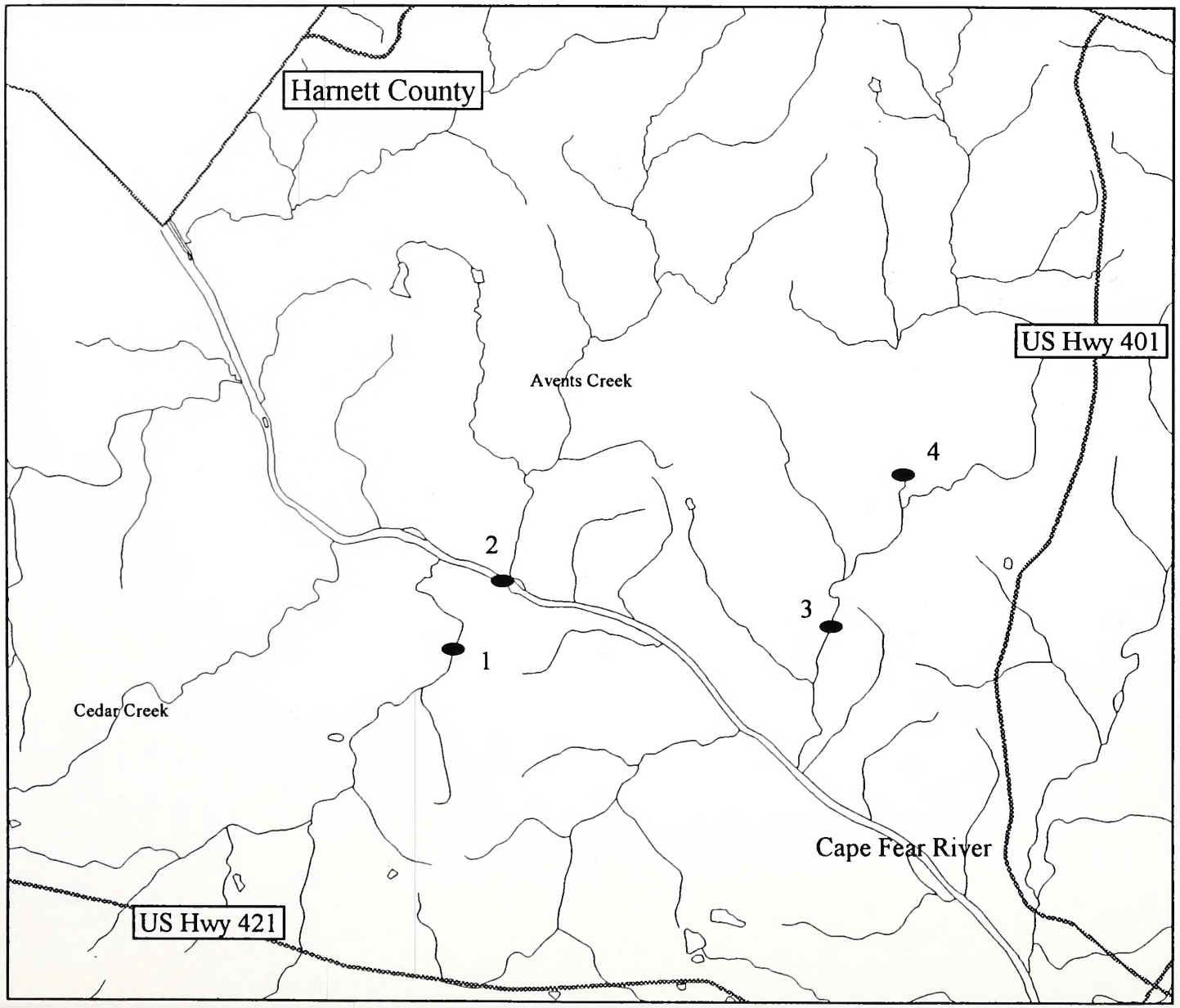
Turgeon, D. D., et. al. 1988. *Common and Scientific Names of Aquatic Invertebrates from the United States and Canada: Mollusks.* American Fisheries Society. Bethesda, MA. 277 + figures pp.

Table 1. Mussels found in the waterways of Raven Rock State Park

Unionidae	
Elliptio congaraea (I. Lea, 1831)	Carolina slabshell
Elliptio folliculata (I. Lea, 1838)	Pod lance
Elliptio roanokensis (I. Lea, 1836)	Roanoke slabshell
Elliptio spp.	
Pyganodon cataracta (Say, 1817)	Eastern floater
Villosa constricta (Conrad, 1838)	Notched rainbow
Villosa delumbis (Conrad, 1834)	Eastern creekshell

RAVEN ROCK STATE PARK
MUSSEL SPECIES INVENTORY

Figure 1.



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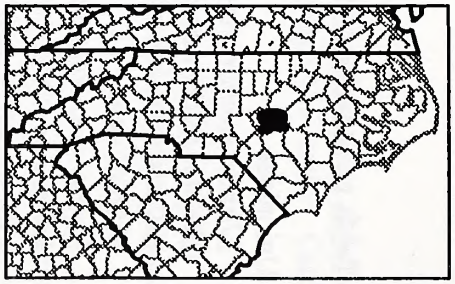

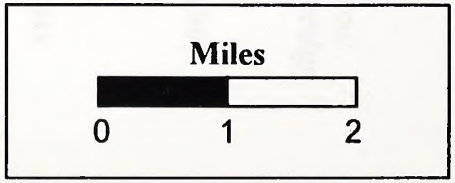

Table 2. Mussels found in Raven Rock State Park and associated waterways

Station No.	Scientific Name	Waterway	Common Locality	County	Date	Number (live)	Number (shell)
960710.2	*Elliptio congaraea*	Cape Fear River	"Fish Traps", RRSP	Harnett Co., NC	10 July 1996	0	Present
960710.2	*Elliptio folliculata*	Cape Fear River	"Fish Traps", RRSP	Harnett Co., NC	10 July 1996	0	Present
960710.2	*Elliptio roanokensis*	Cape Fear River	"Fish Traps", RRSP	Harnett Co., NC	10 July 1996	0	Present
960710.2	*Elliptio spp.*	Cape Fear River	"Fish Traps", RRSP	Harnett Co., NC	10 July 1996	0	Present
960710.2	*Villosa constricta*	Cape Fear River	"Fish Traps", RRSP	Harnett Co., NC	10 July 1996	0	1
960805.1	*Elliptio spp.*	Campbell Creek	Campbell Creek Trail	Harnett Co., NC	5 August 1996	1	0
960805.2	*Elliptio spp.*	Hector Creek	SR 1412	Harnett Co., NC	5 August 1996	3	4
960805.3	*Elliptio spp.*	Hector Creek	SR 1403	Harnett Co., NC	5 August 1996	35	0
970707.1	*Elliptio spp.*	Cape Fear River	"Fish Traps", RRSP	Harnett Co., NC	7 July 1997	273	0
970707.1	*Elliptio congaraea*	Cape Fear River	"Fish Traps", RRSP	Harnett Co., NC	7 July 1997	12	0
970707.1	*Elliption folliculata*	Cape Fear River	"Fish Traps", RRSP	Harnett Co., NC	7 July 1997	7	0
970707.1	*Elliptio roanokensis*	Cape Fear River	"Fish Traps", RRSP	Harnett Co., NC	7 July 1997	6	0
970707.1	*Pyganodon cataracta*	Cape Fear River	"Fish Traps", RRSP	Harnett Co., NC	7 July 1997	0	1
970707.1	*Villosa delumbis*	Cape Fear River	"Fish Traps", RRSP	Harnett Co., NC	7 July 1997	0	1

Crayfish

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NC Wildlife Resources Commission

Introduction

There are currently 338 recognized species of crayfish in the United States and Canada, the greatest diversity of which reside in the Southeast (Taylor et al. 1996). In North Carolina, there are 30 native and 2 introduced species of crayfish (Cooper, pers. comm., 1997). Of these 32 species, nine are listed as significantly rare by the North Carolina Natural Heritage Program (LeGrand and Hall 1995).

Crayfish play a significant role in aquatic ecosystems by representing a large percentage of the biomass in lentic and lotic waters. As prey, they are an important food resource for centrarchids (Rabeni 1992) in addition to birds and mammals (Crocker and Barr 1968). As consumers, they forage for a wide range of nourishment including detritus, aquatic vegetation, arthropods, mollusks, crustaceans, fish, and amphibians (Hobbs III 1993).

Crayfish forage mostly at night and usually seek shelter from predators during daylight hours under cobble and woody debris, in root mats, burrows, or depressions. They are gill breathing organisms and require an aquatic habitat to absorb oxygen from the water. In accordance with habitat preferences, crayfish are classified as either non-burrowers or burrowers. Non-burrowers spend their entire life in the stream bed while burrowers excavate tunnels in roadside ditches, wet pastures, and flood plains (Taylor et al. 1996). Different species of burrowers spend different amounts of their life cycle in subterranean domains.

The average life span of a crayfish is between two and three years (Taylor et al. 1996). During this time, they grow through a series of molts of their exoskeleton. They have five pairs of abdominal appendages called pleopods. The first pleopod pair of the male is modified as a sexual organ. In the family Cambaridae (which includes all North Carolina species), there are two designations for adult male crayfish: Form I and Form II. Throughout their lives, adult males cycle between these forms. Morphologically both forms are similar except in the texture and shape of the first pleopod. Form I males are able to sexually reproduce while Form II males are not. Unlike adult males, adult females do not cycle between morphological forms and once they reach adulthood, they can sexually reproduce.

Although crayfish are common in many freshwater ecosystems, there are significant gaps in our understanding of the distribution, biology, and taxonomy of many species. A recent report on the "Conservation Status of Crayfishes of the United States and Canada"

estimated that in the United States and Canada 50% of crayfish species are "in need of conservation recognition" (Taylor et. al. 1996). In North Carolina, researchers are currently investigating the taxonomy and distribution of approximately ten species which are undescribed or belong to species complexes (Cooper, pers. comm., 1997).

This survey focused on North Carolina state park waterways and their surrounding tributaries. Since the emphasis of the project was on the surface water inhabitants, most of the crayfish collected were non-burrowers. Due to time and weather restrictions, the exact distribution of each species within the state park and its associated waterways was not determined. An estimation was made for the relative abundance of each species collected. In addition, specific habitat preferences for each species were noted.

Methods

Crayfish were surveyed in the Cape Fear River Basin tributaries flowing through Raven Rock State Park (Fig. 1). These included: Avents Creek, Campbell Creek, Cedar Creek, Fish Creek, Hector Creek, Moccasin Branch, and the Cape Fear River. Species were collected with a dipnet and a 6' X 10' mesh net seine. Number 10 (1 gallon) cans were set as pitfall traps (Fig. 2). Collected specimens were preserved and stored in 70% ethanol.

A variety of resources were consulted for identification. "An Illustrated Checklist of the American Crayfishes" (Hobbs 1989) was particularly helpful as well as an unpublished key of North Carolina crayfish (Hobbs 1991). Dr. John Cooper, North Carolina State Museum of Natural Sciences, verified the identification of select specimens and provided further information used for identification. With additional information, the present identifications may be subject to change.

The key feature used to differentiate crayfish species from one another is the morphology and structure of the first pleopod pair of the Form I male. Form II males, juvenile males, and females can be recognized by their carapace, chelae, rostrum shape, and body coloration.

The carapace is the protective exoskeletal plate which encompasses the anterior half of the crayfish body. Its distinguishing features include the depth/width ratio and the placement of spinose ornamentation. The chelae are enlarged claws on the first pair of legs. Their important characteristics are the shape, which can be long and narrow or round and full, and setae, which are present only in some species. The rostrum refers to the anterior most portion of the carapace and it can be spinose or smooth. In terms of coloration, the exoskeleton can be plain, marbled, or striped with shades of blue, brown, tan, olive, and red.

Specimens were recorded as Form I male (MI), Form II male (MII), juvenile male (jM), adult female (F), and juvenile female (jF). Adult versus juvenile specimens were distinguished based on size. Carapace length was measured from the tip of the rostrum to the posterior carapace edge (Page 1985).

Results

Collections were made from 15 sites on 23 days between 17 April 1996 and 9 June 1997. Crayfish were collected or observed at 13 sites (Table 1). One thousand two hundred and thirty trap nights yielded nine crayfish. Four species were collected during the survey: *Cambarus* (*Depressicambarus*) *latimanus* (LeConte, 1856), *Cambarus* (*Lacunicambarus*) *diogenes* (Rafinesque, 1817), *Cambarus* (*Puncticambarus*) *"acuminatus"* (Faxon, 1884), and *Procambarus* (*Ortmannicus*) *acutus acutus* (Girard, 1852). In addition, two aberrant *Cambarus* (*P.*) *"acuminatus"* specimens may prove to be an additional species (Cooper, pers. comm., 1997) and are currently referred to as *Cambarus* sp.

Cambarus (*P.*) *"acuminatus"* was most commonly found in cobble and boulder substrates in riffle/run habitats. Other habitats included cobble and boulder along river shorelines and root mat pools. A total of 39 specimens were observed (1 MI, 11 MII, 10 jM, 7 F, 10 jF). Carapace length ranged from 13.75 to 36.90 mm; mean length was 23.88 (±6.36) mm. The Form I male was collected on 11 March 1997. Two bright green specimens (1 MI, 1 F) were collected from Moccasin Branch on 11 March 1997. Two juvenile males, collected from Campbell Creek, had unusual spinose ornamentation on the anterior carapace and were designated as *Cambarus* sp.

Cambarus (*D.*) *latimanus* was collected from gravel and cobble substrate in riffle/run habitats. They were also found in shallow back-water pools with cobble substrate. A total of 19 specimens were observed (8 jM, 11 jF). Carapace length ranged from 9.15 to 21.55 mm; mean length was 15.92 (±3.41) mm.

Cambarus (*L.*) *diogenes* was collected in the pitfall traps set in the Fish Creek flood plain. Nine members of this species were collected (1 MII, 3 jM, 4 F, 1 jF). Carapace length ranged from 10.95 to 36.00 mm; mean length was 22.75 (±10.29) mm. A female with eggs attached was collected on 27 March 1997.

Procambarus (*O.*) *a. acutus* was found most commonly in run and pool habitats with sand substrate and woody debris. In addition they were collected from root mat pools and piles of leaf litter on the stream bottom. A total of 6 specimens were observed or collected (3 F, 3 jF). Carapace length ranged from 14.20 to 34.50 mm; mean length was 26.06 (±8.70) mm.

Discussion

Crayfish diversity and abundance are good in the Cape Fear River Basin tributaries which flow through Raven Rock State Park. Most stations surveyed provided habitat for at least one species of crayfish and several hosted three species.

Cambarus (*P.*) *"acuminatus"* was abundant throughout the sampled area in many different habitat types. Specimens were collected in all stages of the crayfish life cycle, which supports literature suggesting they are primarily a non-burrowing species and thus spend most of their life in the surface water habitats (Hobbs 1989). The *C. (P.) "acuminatus"* specimens collected from this area are part of a larger species complex, *Cambarus* (*Puncticambarus*) sp. C. This complex occurs across the Coastal Plain, Piedmont, and Mountain physiographic regions of North Carolina and currently awaits further clarification (Cooper and Braswell 1995).

Cambarus (*D.*) *latimanus* was common to abundant throughout the surveyed area. All of the collected specimens were juveniles and were associated with a wide variety of habitat types. *C.* (*D.*) *latimanus* is a burrowing species which spends part of its life cycle in subterranean habitats (Hobbs 1989), and this may explain the absence of adults among the specimens collected.

The population of *Cambarus* (*L.*) *diogenes* appeared to be prospering in the Fish Creek floodplain area. Burrows and chimneys in this area were abundant and displayed moist soil depositions indicating high levels of crayfish activity.

Procambarus (*O.*) *a. acutus* was common throughout the surveyed area. Its habitat appeared to be restricted to low flow waters and pool areas which concurs with Hobbs (1989) designation of its habitat type as "sluggish to moderately flowing streams and most lentic situations."

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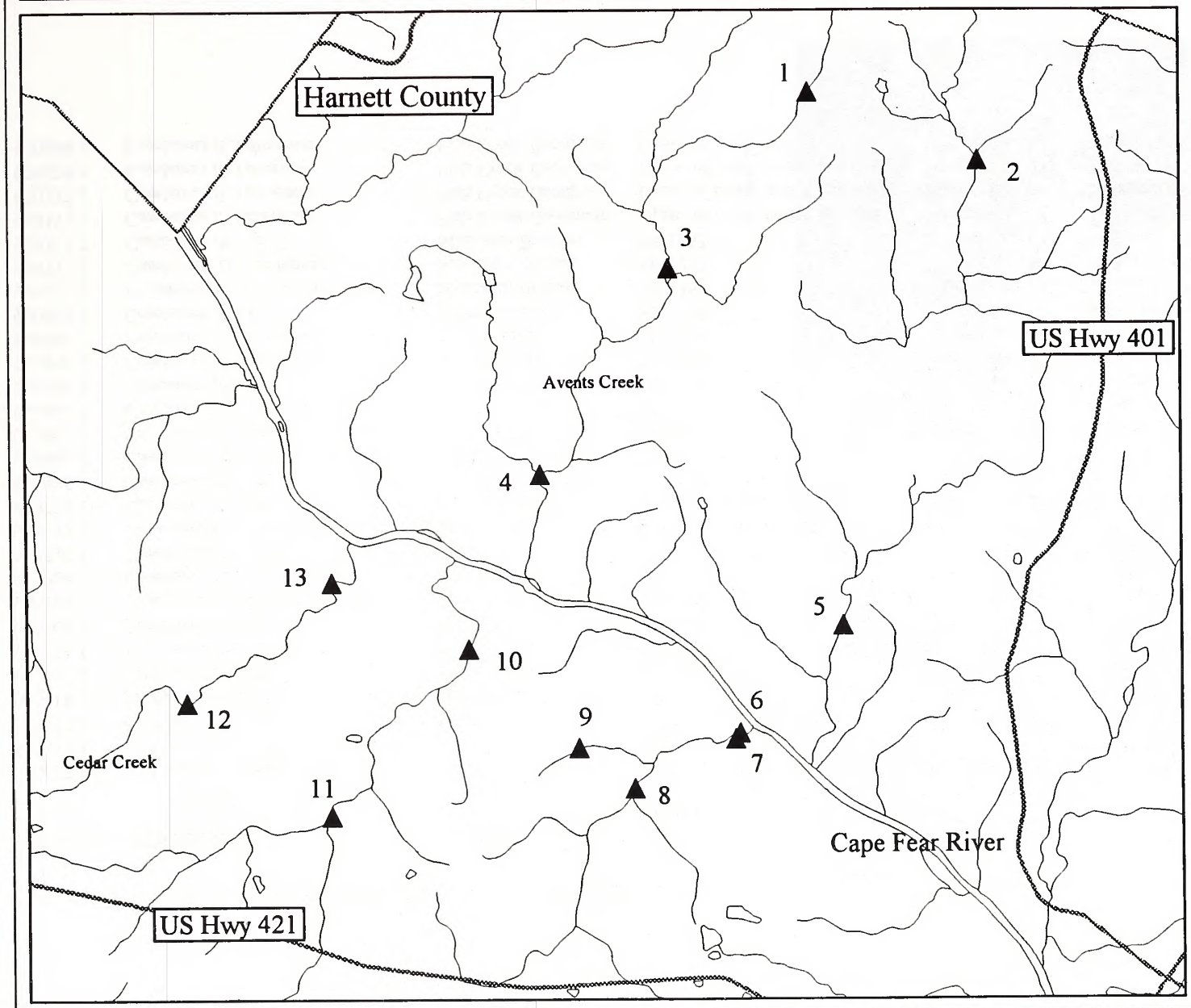
RAVEN ROCK STATE PARK
CRAYFISH SPECIES INVENTORY

Figure 1.



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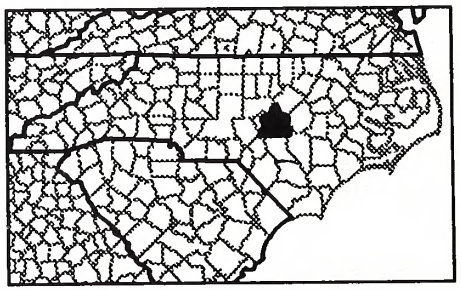

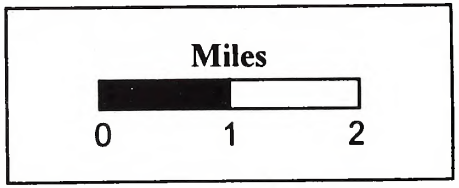

Table 1. Crayfish found in Raven Rock State Park and associated waterways

Station No.	Scientific Name	Waterway	Common Locality	County	Date	Number/Sex	Identified By
960417.1	*Cambarus (D.) latimanus*	Fish Creek	Upstr.of confl. with Cape Fear	Harnett Co., NC	17 April 1996	3F	M.E. Savacool
960417.1	*Cambarus (P.) sp. C*	Fish Creek	Upstr.of confl. with Cape Fear	Harnett Co., NC	17 April 1996	2jM	M.E. Savacool
960417.2	*Cambarus (P.) sp. C*	Campbell Creek	Upstr.of confl. with Cape Fear	Harnett Co., NC	17 April 1996	1F	M.E. Savacool
960418.1	*Procambarus (O.) acutus acutus*	Avents Creek	SR 1418	Harnett Co., NC	18 April 1996	2jF	M.E. Savacool
960701.1	*Cambarus (P.) sp. C*	Cedar Creek	SR 1265	Harnett Co., NC	1 July 1996	5MII, 1jM, 3F, 1jF	M.E. Savacool
960701.1	*Procambarus (O.) acutus acutus*	Cedar Creek	SR 1265	Harnett Co., NC	1 July 1996	1F	M.E. Savacool
960708.1	*Cambarus (P.) sp. C*	Fish Creek	SR 1257	Harnett Co., NC	8 July 1996	1F	M.E. Savacool
960708.1	*Procambarus (O.) acutus acutus*	Fish Creek	SR 1257	Harnett Co., NC	8 July 1996	1F	M.E. Savacool
960708.1	*Cambarus (D.) latimanus*	Fish Creek	SR 1257	Harnett Co., NC	8 July 1996	4jM, 2jF	M.E. Savacool
960710.1	*Cambarus (P.) sp. C*	Cedar Creek	Upstr. of confl. with Cape Fear	Harnett Co., NC	10 July 1996	2MII, 3jM, 1F, 1jF	M.E. Savacool
960715.1	*Cambarus (L.) diogenes*	Fish Creek floodplain	Upstr.of confl. with Cape Fear	Harnett Co., NC	15 July 1996	1MII, 3jM, 1jF	J.E. Cooper, M.E. Savacool
960723.1	*Cambarus (P.) sp. C*	Avents Creek	SR 1418 (upper crossing)	Harnett Co., NC	23 July 1995	1MII, 1jM, 1jF	M.E. Savacool
960805.1	*Cambarus (P.) sp. C*	Campbell Creek	Campbell Cr. Trail	Harnett Co., NC	5 August 1996	2jM	J.E. Cooper, M.E. Savacool
960805.1	*Cambarus (P.) sp. C*	Campbell Creek	Campbell Cr. Trail	Harnett Co., NC	5 August 1996	1MII, 1jM, 1jF	J.E. Cooper, M.E. Savacool
960805.2	*Cambarus (P.) sp. C*	Hector Creek	SR 1412	Harnett Co., NC	5 August 1996	1F	M.E. Savacool
960806.1	*Cambarus (D.) latimanus*	Hector Creek	SR 1415	Harnett Co., NC	6 August 1996	1Jf	M.E. Savacool
960806.1	*Cambarus (P.) sp. C*	Hector Creek	SR 1415	Harnett Co., NC	6 August 1996	2Jf	M.E. Savacool
960806.2	*Cambarus (D.) latimanus*	Avents Creek	SR 1409	Harnett Co., NC	6 August 1996	1MII, 3jM, 1jF	M.E. Savacool
960806.2	*Procambarus (O.) acutus acutus*	Avents Creek	SR 1409	Harnett Co., NC	6 August 1996	1F	M.E. Savacool
960806.2	*Cambarus (P.) sp. C*	Avents Creek	SR 1409	Harnett Co., NC	6 August 1996	4MII, 2F, 1jF	M.E. Savacool
970311.2	*Procambarus (O.) acutus acutus*	Moccasin Branch	SR 1262	Harnett Co., NC	11 March 1997	1F	M.E. Savacool
970311.2	*Cambarus (D.) latimanus*	Moccasin Branch	SR 1262	Harnett Co., NC	11 March 1997	4jF	M.E. Savacool
970311.2	*Cambarus (P.) sp. C*	Moccasin Branch	SR 1262	Harnett Co., NC	11 March 1997	1MI, 1F	M.E. Savacool
970317.1	*Cambarus (L.) diogenes*	Fish Creek floodplain	Upstr. of confl. with Cape Fear	Harnett Co., NC	17 March 1997	claw	M.E. Savacool
970327.1	*Cambarus (L.) diogenes*	Fish Creek floodplain	Upstr. of confl. with Cape Fear	Harnett Co., NC	27 March 1997	1F w/eggs	M.E. Savacool
970528.1	*Cambarus (L.) diogenes*	Fish Creek floodplain	Upstr. of confl. with Cape Fear	Harnett Co., NC	28 May 1997	1F	M.E. Savacool
970609.1	*Cambarus (L.) diogenes*	Fish Creek floodplain	Upstr. of confl. with Cape Fear	Harnett Co., NC	9 June 1997	2F	M.E. Savacool

Figure 2. Pitfall trap set in the Fish Creek floodplain

Freshwater Fishes

Gabriela B. Mottesi, Nongame Biologist
Nongame and Endangered Wildlife Program
Division of Wildlife Management
NC Wildlife Resources Commission

Introduction

Approximately 790 fish species are believed to occur in the freshwaters of the United States and Canada (Page & Burr 1991). More than 225 species can be found in North Carolina (Menhinick 1991). This unusually rich and variable fish fauna is due to a great diversity of habitats found within the state and to different zoogeographic distribution patterns of various species. Many game species, several bait and forage species, and at least one aquarium species have become established in North Carolina waters (Menhinick 1991).

Unfortunately, almost one quarter of the fish occurring in North Carolina are state listed as Endangered, Threatened, or Special Concern species. This is of concern since fish are important components of aquatic ecosystems; they are indicators of water quality; and many species are a source of recreation for the state's citizens. Therefore, it is important that we determine their status/distributions and apply proper conservation techniques where necessary.

Methods

Fish were surveyed in the Cape Fear River Basin tributaries flowing through Raven Rock State Park. These included: Avents Creek, Campbell Creek, Cedar Creek, Fish Creek, Hector Creek, Moccasin Branch, and the Cape Fear River (Fig. 1, Introduction Section). Most habitats can be described as riffle/run with medium to fast flow. Pools of different sizes with slow flow were also present. Substrate included combinations of silt, sand, gravel, cobble, boulder, and bedrock. Some aquatic vegetation and organic debris were also present.

Fish were mostly collected at bridge crossings. Collecting techniques included the use of a 6' x 10' minnow seine, and dip nets. Different techniques of seining, such as kicking, and setting and dragging, were utilized according to the habitat. Specimens were fixed in 10% formalin and preserved in 70% ethanol. Specimens not collected were returned unharmed.

The following sources were used as identification tools: Jenkins (1995), Menhinick (1991), Page (1983), and Page and Burr (1991). Some identifications were verified using specimens from the collection of the NC State Museum of Natural Sciences. With the acquisition of more information, identifications may be subject to change.

Results and Discussion

Figure 1 details the localities of the thirteen stations where fish were found. Twenty-seven species of fish representing ten families were found within the waterways associated with Raven Rock State Park (Table 1).

The habitat diversity within the waterways associated with Raven Rock State Park allows for the co-existance of species with diverse habitat requirements. Species which prefer deeper pool areas, such as *Lepomis cyanellus* Rafinesque, 1819, *Lepomis macrochirus* Rafinesque, 1819, and *Micropterus salmoides* (Lacepède, 1802) were found. *Gambusia holbrooki* Girard, 1859 and *Fundulus rathbuni* Jordan & Meek, 1889, which are surface dwellers, were located.

Open water species including *Notropis altipinnis* (Cope, 1870), *Cyprinella analostana* Girard, 1859, and *Moxostoma anisurum* (Rafinesque, 1820) were also found. These waterways also provided significant leaf litter and woody debris for *Aphredoderus sayanus* (Gilliams, 1824) and *Noturus gyrinus* (Mitchill, 1817) which require cover. Species which prefer a riffle/run habitat, such as *Percina crassa* (Jordan & Brayton, 1878) were also detected. These are just a few examples of the species and habitat diversity found within the waterways associated with Raven Rock State Park.

Fish diversity and abundance are good within the waterways associated with Raven Rock State Park (Table 2).

Resources

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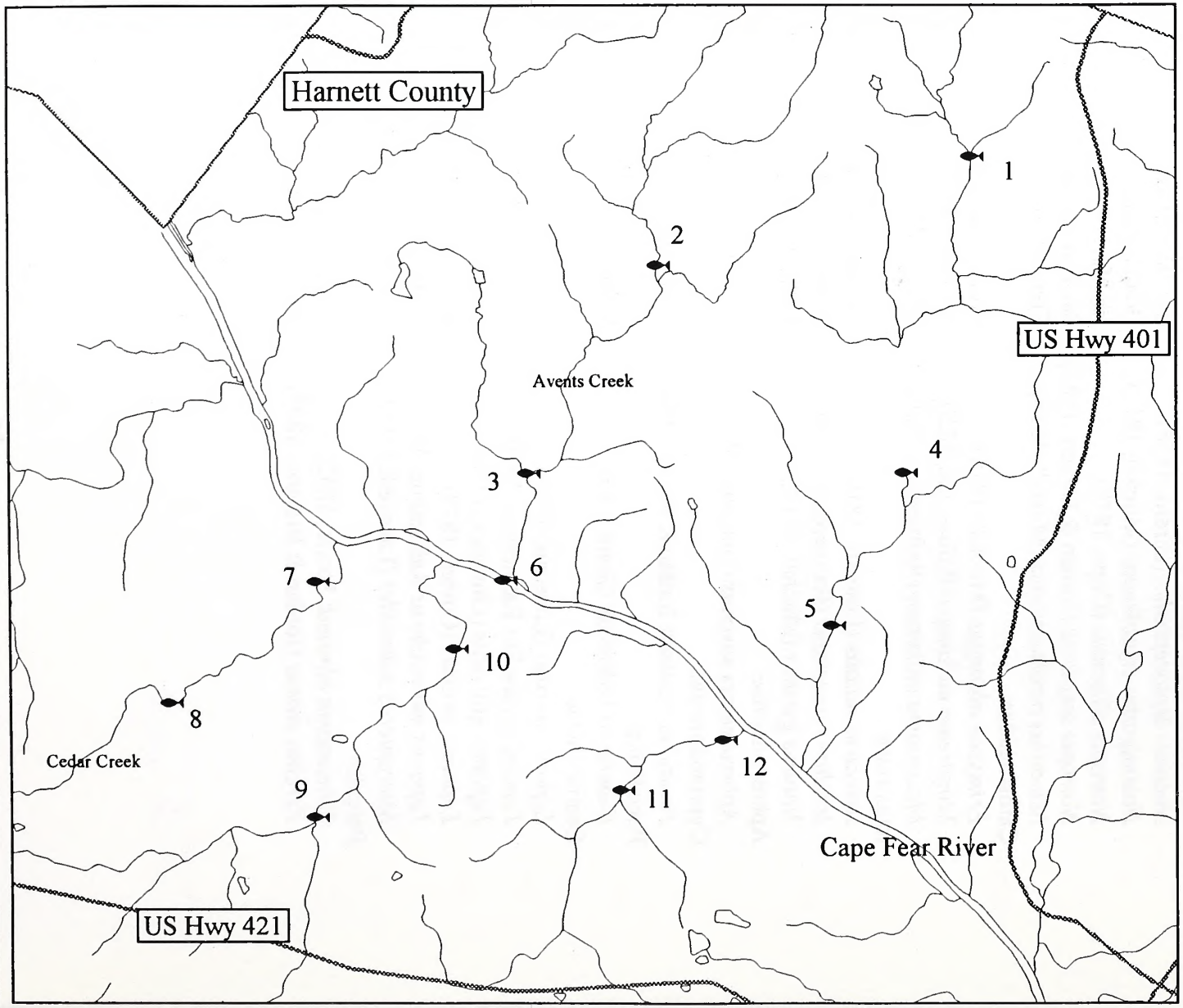
Table 1. Fish found in the waterways of Raven Rock State Park

Anguillidae	
Anguilla rostrata (Lesueur, 1817)	American eel
Esocidae	
Esox americanus Gmelin, 1788	Redfin pickerel
Cyprinidae	
Clinostomus funduloides Girard, 1856	Rosyside dace
Cyprinella analostana Girard, 1859	Satinfin shiner
Luxilus albeolus (Jordan, 1889)	White shiner
Nocomis leptocephalus (Girard, 1856)	Bluehead chub
Notemigonus crysoleucas (Mitchill, 1814)	Golden shiner
Notropis altipinnis (Cope, 1870)	Highfin shiner
Notropis scepticus (Jordan & Gilbert, 1883)	Sandbar shiner
Semotilus atromaculatus (Mitchill, 1818)	Creek chub
Catostomidae	
Erimyzon oblongus (Mitchill, 1814)	Creek chubsucker
Minytrema melanops (Rafinesque, 1820)	Spotted sucker
Moxostoma anisurum (Rafinesque, 1820)	Silver redhorse
Ictaluridae	
Ameiurus natalis (Lesueur, 1819)	Yellow bullhead
Ictalurus punctatus (Rafinesque, 1818)	Channel catfish
Noturus gyrinus (Mitchill, 1817)	Tadpole madtom
Aphredoderidae	
Aphredoderus sayanus (Gilliams, 1824)	Pirate perch
Cyprinodontidae	
Fundulus rathbuni Jordan & Meek, 1889	Speckled killifish
Poeciliidae	
Gambusia holbrooki Girard, 1859	Eastern mosquitofish
Centrarchidae	
Lepomis auritus (Linnaeus, 1758)	Redbreast sunfish
Lepomis cyanellus Rafinesque, 1819	Green sunfish
Lepomis gibbosus (Linnaeus, 1758)	Pumpkinseed sunfish
Lepomis gulosus (Cuvier, 1829)	Warmouth
Lepomis macrochirus Rafinesque, 1819	Bluegill sunfish
Micropterus salmoides (Lacepède, 1802)	Largemouth bass
Percidae	
Etheostoma olmstedi Storer, 1842	Tessellated darter
Percina crassa (Jordan & Brayton, 1878)	Piedmont darter

RAVEN ROCK STATE PARK
FISH SPECIES INVENTORY

Figure 1.



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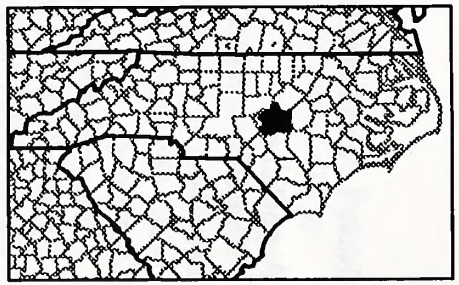

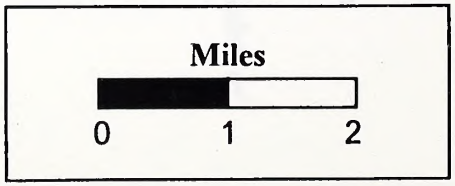

Table 2. Fish found in Raven Rock State Park and associated waterways

Station No.	Scientific Name	Waterway	Common Locality	County	Date	Number	Identified By
960417.1	*Notropis altipinnis*	Fish Creek	Upstr. from confl. with Cape Fear	Harnett Co., NC	17 April 1996	2	G.B. Mottesi
960417.1	*Etheostoma olmstedi*	Fish Creek	Upstr. from confl. with Cape Fear	Harnett Co., NC	17 April 1996	4	G.B. Mottesi
960417.2	*Luxilus albeolus*	Campbell Creek	SR 1265	Harnett Co., NC	17 April 1996	2	G.B. Mottesi
960417.2	*Semotilus atromaculatus*	Campbell Creek	SR 1265	Harnett Co., NC	17 April 1996	1	G.B. Mottesi
960417.2	*Nocomis leptocephalus*	Campbell Creek	SR 1265	Harnett Co., NC	17 April 1996	2	G.B. Mottesi
960417.2	*Notropis altipinnis*	Campbell Creek	SR 1265	Harnett Co., NC	17 April 1996	1	G.B. Mottesi
960417.2	*Lepomis gibbosus*	Campbell Creek	SR 1265	Harnett Co., NC	17 April 1996	1	G.B. Mottesi
960417.2	*Etheostoma olmstedi*	Campbell Creek	SR 1265	Harnett Co., NC	17 April 1996	3	G.B. Mottesi
960417.2	*Esox americanus*	Campbell Creek	SR 1265	Harnett Co., NC	17 April 1996	1	G.B. Mottesi
960417.2	*Erimyzon oblongus*	Campbell Creek	SR 1265	Harnett Co., NC	17 April 1996	1	G.B. Mottesi
960418.1	*Etheostoma olmstedi*	Avents Creek	SR 1418	Harnett Co., NC	18 April 1996	8	G.B. Mottesi
960418.1	*Lepomis auritus*	Avents Creek	SR 1418	Harnett Co., NC	18 April 1996	2	G.B. Mottesi
960418.1	*Lepomis gibbosus*	Avents Creek	SR 1418	Harnett Co., NC	18 April 1996	1	G.B. Mottesi
960418.1	*Luxilus albeolus*	Avents Creek	SR 1418	Harnett Co., NC	18 April 1996	3	G.B. Mottesi
960418.1	*Nocomis leptocephalus*	Avents Creek	SR 1418	Harnett Co., NC	18 April 1996	8	G.B. Mottesi
960701.1	*Lepomis cyanellus*	Cedar Creek	SR 1265	Harnett Co., NC	1 July 1996	2	G.B. Mottesi
960701.1	*Lepomis macrochirus*	Cedar Creek	SR 1265	Harnett Co., NC	1 July 1996	9	G.B. Mottesi
960701.1	*Lepomis auritus*	Cedar Creek	SR 1265	Harnett Co., NC	1 July 1996	1	G.B. Mottesi
960701.1	*Micropterus salmoides*	Cedar Creek	SR 1265	Harnett Co., NC	1 July 1996	5	G.B. Mottesi
960701.1	*Nocomis leptocephalus*	Cedar Creek	SR 1265	Harnett Co., NC	1 July 1996	2	G.B. Mottesi
960701.1	*Semotilus atromaculatus*	Cedar Creek	SR 1265	Harnett Co., NC	1 July 1996	7	G.B. Mottesi
960701.1	*Luxilus albeolus*	Cedar Creek	SR 1265	Harnett Co., NC	1 July 1996	4	G.B. Mottesi
960701.1	*Fundulus rathbuni*	Cedar Creek	SR 1265	Harnett Co., NC	1 July 1996	5	G.B. Mottesi
960701.1	*Etheostoma olmstedi*	Cedar Creek	SR 1265	Harnett Co., NC	1 July 1996	2	G.B. Mottesi
960701.1	*Esox americanus*	Cedar Creek	SR 1265	Harnett Co., NC	1 July 1996	1	G.B. Mottesi
960701.1	*Erimyzon oblongus*	Cedar Creek	SR 1265	Harnett Co., NC	1 July 1996	3	G.B. Mottesi
960701.1	*Clinostomus funduloides*	Cedar Creek	SR 1265	Harnett Co., NC	1 July 1996	4	G.B. Mottesi
960701.1	*Aphredoderus sayanus*	Cedar Creek	SR 1265	Harnett Co., NC	1 July 1996	1	G.B. Mottesi
960708.1	*Semotilus atromaculatus*	Fish Creek	SR 1257	Harnett Co., NC	8 July 1996	9	G.B. Mottesi
960708.1	*Noturus gyrinus*	Fish Creek	SR 1257	Harnett Co., NC	8 July 1996	4	G.B. Mottesi
960708.1	*Nocomis leptocephalus*	Fish Creek	SR 1257	Harnett Co., NC	8 July 1996	2	G.B. Mottesi
960708.1	*Micropterus salmoides*	Fish Creek	SR 1257	Harnett Co., NC	8 July 1996	2	G.B. Mottesi
960708.1	*Luxilus albeolus*	Fish Creek	SR 1257	Harnett Co., NC	8 July 1996	14	G.B. Mottesi
960708.1	*Lepomis macrochirus*	Fish Creek	SR 1257	Harnett Co., NC	8 July 1996	1	G.B. Mottesi
960708.1	*Lepomis gulosus*	Fish Creek	SR 1257	Harnett Co., NC	8 July 1996	1	G.B. Mottesi
960708.1	*Lepomis gibbosus*	Fish Creek	SR 1257	Harnett Co., NC	8 July 1996	6	G.B. Mottesi

Table 2. Fish found in Raven Rock State Park and associated waterways (cont.)

Station No.	Scientific Name	Waterway	Common Locality	County	Date	Number	Identified By
960708.1	*Lepomis cyanellus*	Fish Creek	SR 1257	Harnett Co., NC	8 July 1996	1	G.B. Mottesi
960708.1	*Lepomis auritus*	Fish Creek	SR 1257	Harnett Co., NC	8 July 1996	2	G.B. Mottesi
960708.1	*Etheostoma olmstedi*	Fish Creek	SR 1257	Harnett Co., NC	8 July 1996	4	G.B. Mottesi
960708.1	*Erimyzon oblongus*	Fish Creek	SR 1257	Harnett Co., NC	8 July 1996	7	G.B. Mottesi
960708.1	*Clinostomus funduloides*	Fish Creek	SR 1257	Harnett Co., NC	8 July 1996	1	G.B. Mottesi
960708.1	*Aphredoderus sayanus*	Fish Creek	SR 1257	Harnett Co., NC	8 July 1996	1	G.B. Mottesi
960708.1	*Ameiurus natalis*	Fish Creek	SR 1257	Harnett Co., NC	8 July 1996	1	G.B. Mottesi
960710.1	*Semotilus atromaculatus*	Cedar Creek	Upstr. from confl. with Cape Fear	Harnett Co., NC	10 July 1996	13	G.B. Mottesi
960710.1	*Percina crassa*	Cedar Creek	Upstr. from confl. with Cape Fear	Harnett Co., NC	10 July 1996	4	G.B. Mottesi
960710.1	*Notropis chalybaeus*	Cedar Creek	Upstr. from confl. with Cape Fear	Harnett Co., NC	10 July 1996	1	G.B. Mottesi
960710.1	*Notropis altipinnis*	Cedar Creek	Upstr. from confl. with Cape Fear	Harnett Co., NC	10 July 1996	11	G.B. Mottesi
960710.1	*Minytrema melanops*	Cedar Creek	Upstr. from confl. with Cape Fear	Harnett Co., NC	10 July 1996	2	G.B. Mottesi
960710.1	*Lepomis macrochirus*	Cedar Creek	Upstr. from confl. with Cape Fear	Harnett Co., NC	10 July 1996	4	G.B. Mottesi
960710.1	*Micropterus salmoides*	Cedar Creek	Upstr. from confl. with Cape Fear	Harnett Co., NC	10 July 1996	2	G.B. Mottesi
960710.1	*Lepomis auritus*	Cedar Creek	Upstr. from confl. with Cape Fear	Harnett Co., NC	10 July 1996	2	G.B. Mottesi
960710.1	*Fundulus rathbuni*	Cedar Creek	Upstr. from confl. with Cape Fear	Harnett Co., NC	10 July 1996	1	G.B. Mottesi
960710.1	*Etheostoma olmstedi*	Cedar Creek	Upstr. from confl. with Cape Fear	Harnett Co., NC	10 July 1996	3	G.B. Mottesi
960710.1	*Erimyzon oblongus*	Cedar Creek	Upstr. from confl. with Cape Fear	Harnett Co., NC	10 July 1996	1	G.B. Mottesi
960710.1	*Cyprinella analostana*	Cedar Creek	Upstr. from confl. with Cape Fear	Harnett Co., NC	10 July 1996	5	G.B. Mottesi
960710.1	*Clinostomus funduloides*	Cedar Creek	Upstr. from confl. with Cape Fear	Harnett Co., NC	10 July 1996	2	G.B. Mottesi
960710.1	*Aphredoderus sayanus*	Cedar Creek	Upstr. from confl. with Cape Fear	Harnett Co., NC	10 July 1996	2	G.B. Mottesi
960710.2	*Percina crassa*	Cape Fear River	"Fish Traps", RRSP	Harnett Co., NC	10 July 1996	6	G.B. Mottesi
960710.2	*Notropis scepticus*	Cape Fear River	"Fish Traps", RRSP	Harnett Co., NC	10 July 1996	12	G.B. Mottesi
960710.2	*Notropis altipinnis*	Cape Fear River	"Fish Traps", RRSP	Harnett Co., NC	10 July 1996	4	G.B. Mottesi
960710.2	*Nocomis leptocephalus*	Cape Fear River	"Fish Traps", RRSP	Harnett Co., NC	10 July 1996	2	G.B. Mottesi
960710.2	*Moxostoma anisurum*	Cape Fear River	"Fish Traps", RRSP	Harnett Co., NC	10 July 1996	2	G.B. Mottesi
960710.2	*Lepomis macrochirus*	Cape Fear River	"Fish Traps", RRSP	Harnett Co., NC	10 July 1996	3	G.B. Mottesi
960710.2	*Ictalurus punctatus*	Cape Fear River	"Fish Traps", RRSP	Harnett Co., NC	10 July 1996	1	G.B. Mottesi
960710.2	*Fundulus rathbuni*	Cape Fear River	"Fish Traps", RRSP	Harnett Co., NC	10 July 1996	2	G.B. Mottesi
960710.2	*Etheostoma olmstedi*	Cape Fear River	"Fish Traps", RRSP	Harnett Co., NC	10 July 1996	3	G.B. Mottesi
960710.2	*Cyprinella analostana*	Cape Fear River	"Fish Traps", RRSP	Harnett Co., NC	10 July 1996	10	G.B. Mottesi
960723.1	*Etheostoma olmstedi*	Avents Creek	SR 1418 (upper crossing)	Harnett Co., NC	23 July 1996	3	G.B. Mottesi
960723.1	*Gambusia holbrooki*	Avents Creek	SR 1418 (upper crossing)	Harnett Co., NC	23 July 1996	1	G.B. Mottesi
960723.1	*Lepomis auritus*	Avents Creek	SR 1418 (upper crossing)	Harnett Co., NC	23 July 1996	1	G.B. Mottesi
960723.1	*Lepomis macrochirus*	Avents Creek	SR 1418 (upper crossing)	Harnett Co., NC	23 July 1996	1	G.B. Mottesi
960723.1	*Luxilus albeolus*	Avents Creek	SR 1418 (upper crossing)	Harnett Co., NC	23 July 1996	1	G.B. Mottesi

Table 2. Fish found in Raven Rock State Park and associated waterways (cont.)

Station No.	Scientific Name	Waterway	Common Locality	County	Date	Number	Identified By
960723.1	*Micropterus salmoides*	Avents Creek	SR 1418 (upper crossing)	Harnett Co., NC	23 July 1996	1	G.B. Mottesi
960723.1	*Nocomis leptocephalus*	Avents Creek	SR 1418 (upper crossing)	Harnett Co., NC	23 July 1996	3	G.B. Mottesi
960723.1	*Semotilus atromaculatus*	Avents Creek	SR 1418 (upper crossing)	Harnett Co., NC	23 July 1996	2	G.B. Mottesi
960805.1	*Notropis altipinnis*	Campbell Creek	Campbell Creek Trail	Harnett Co., NC	5 August 1996	2	G.B. Mottesi
960805.1	*Nocomis leptocephalus*	Campbell Creek	Campbell Creek Trail	Harnett Co., NC	5 August 1996	4	G.B. Mottesi
960805.1	*Percina crassa*	Campbell Creek	Campbell Creek Trail	Harnett Co., NC	5 August 1996	2	G.B. Mottesi
960805.1	*Lepomis auritus*	Campbell Creek	Campbell Creek Trail	Harnett Co., NC	5 August 1996	1	G.B. Mottesi
960805.1	*Luxilus albeolus*	Campbell Creek	Campbell Creek Trail	Harnett Co., NC	5 August 1996	8	G.B. Mottesi
960805.1	*Etheostoma olmstedi*	Campbell Creek	Campbell Creek Trail	Harnett Co., NC	5 August 1996	2	G.B. Mottesi
960805.1	*Micropterus salmoides*	Campbell Creek	Campbell Creek Trail	Harnett Co., NC	5 August 1996	1	G.B. Mottesi
960805.2	*Cyprinella analostana*	Hector Creek	SR 1412	Harnett Co., NC	5 August 1996	2	G.B. Mottesi
960805.2	*Fundulus rathbuni*	Hector Creek	SR 1412	Harnett Co., NC	5 August 1996	6	G.B. Mottesi
960805.2	*Lepomis auritus*	Hector Creek	SR 1412	Harnett Co., NC	5 August 1996	1	G.B. Mottesi
960805.2	*Lepomis macrochirus*	Hector Creek	SR 1412	Harnett Co., NC	5 August 1996	3	G.B. Mottesi
960805.2	*Luxilus albeolus*	Hector Creek	SR 1412	Harnett Co., NC	5 August 1996	13	G.B. Mottesi
960805.2	*Micropterus salmoides*	Hector Creek	SR 1412	Harnett Co., NC	5 August 1996	1	G.B. Mottesi
960805.2	*Nocomis leptocephalus*	Hector Creek	SR 1412	Harnett Co., NC	5 August 1996	4	G.B. Mottesi
960805.2	*Notemigonus crysoleucas*	Hector Creek	SR 1412	Harnett Co., NC	5 August 1996	1	G.B. Mottesi
960805.2	*Semotilus atromaculatus*	Hector Creek	SR 1412	Harnett Co., NC	5 August 1996	1	G.B. Mottesi
960805.3	*Luxilus albeolus*	Hector Creek	SR 1403	Harnett Co., NC	5 August 1996	6	G.B. Mottesi
960805.3	*Nocomis leptocephalus*	Hector Creek	SR 1403	Harnett Co., NC	5 August 1996	4	G.B. Mottesi
960805.3	*Micropterus salmoides*	Hector Creek	SR 1403	Harnett Co., NC	5 August 1996	3	G.B. Mottesi
960805.3	*Etheostoma olmstedi*	Hector Creek	SR 1403	Harnett Co., NC	5 August 1996	1	G.B. Mottesi
960805.3	*Lepomis macrochirus*	Hector Creek	SR 1403	Harnett Co., NC	5 August 1996	1	G.B. Mottesi
960805.3	*Lepomis auritus*	Hector Creek	SR 1403	Harnett Co., NC	5 August 1996	4	G.B. Mottesi
960805.3	*Fundulus rathbuni*	Hector Creek	SR 1403	Harnett Co., NC	5 August 1996	1	G.B. Mottesi
960806.1	*Etheostoma olmstedi*	Hector Creek	SR 1415	Harnett Co., NC	6 August 1996	1	G.B. Mottesi
960806.1	*Luxilus albeolus*	Hector Creek	SR 1415	Harnett Co., NC	6 August 1996	1	G.B. Mottesi
960806.1	*Micropterus salmoides*	Hector Creek	SR 1415	Harnett Co., NC	6 August 1996	2	G.B. Mottesi
960806.1	*Nocomis leptocephalus*	Hector Creek	SR 1415	Harnett Co., NC	6 August 1996	1	G.B. Mottesi
970707.1	*Anguilla rostrata*	Cape Fear River	"Fish Traps", RRSP	Harnett Co., NC	7 July 1997	1	G.B Mottesi
970707.1	*Percina crassa*	Cape Fear River	"Fish Traps", RRSP	Harnett Co., NC	7 July 1997	5	G.B. Mottesi